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PHYSICOCHEMICAL AND FUNCTIONAL CHARACTERISTICS OF BEVERAGE SUGAR APPLE POWDERED ON LEVEL CONCENTRATION DIFFERENT OF CMC

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ABSTRACT

The intermediate products of sugar apple do not have an entrepreneurial aspects though they have a longer shelf life than the fresh fruit form unless it processed into the final products of beverages or foods. Therefore it need to continue the processing of sugar apple intermediate products. Some products of them which have a clear prospect entrepreneur among others as both of beverages and functional foods. The Short-term goal of this research is to process the intermediate product into a beverage sugar apple powdered among others. Subsequently the long-term goal of this research is to find ways of processing the intermediate products into final ones that have nutritional value and adequate antioxidants. The results showed that the use of CMC 0.5% gives a better physicochemical and functional characteristics on powdered product of sugar apple. Making the beverage product by filtering the pulp giving better quality of both physicochemical and functional characteristics than without filtering the fleshy part.

Key Words : CMC, functional characteristics beverage powdered, intermediate product, physicochemical, sugar apple.

INTRODUCTION

As the region is dominated by dry land, valley of Palu has a distinctive point particularly the biodiversity of plants that survive to grow in the condition, sugar apple is the one of resistant plants in this area. Although this plant can bear fruit throughout the year, but commercial cultivation of this crop has not been done because utilization is not optimal. These conditions cause the sugar apple fruit becomes scarce at certain times but otherwise become waste in the harvest period in which the sale price in the market is not profitable for farmers and traders.

Engineering treatment process is an improvement of existing treatment processes. The process is expected to extend the usability of sugar apple fruit to maintain the continuity of the consumption of this fruit.

Fresh storage of sugar apple fruit becomes a limiting factor because of the perishable characteristic. Contrarily, low temperature storage is not possible because it can cause the brown color of the skin of the fruit so lowering the selling price in the market.

Pulp of sugar apple contains a lot of sugar reduction, vitamins and minerals that can increase blood sugar levels (Cardoso *et al.,* 2011). Agronomic aspects of sugar apple crop is relatively easy because it does not require special handling, but is capable of producing abundant fruits at harvest time even very often damaged due to inadequate preservation techniques. Canning fruit flesh (pulp) is a constraint due to the appearance of bitter taste and browning at the heating temperature of over 55°C (Muñoz *et al.,* 2001). In addition, pulp unpleasant flavor will develop if the heating temperature is over 65°C (Bora *et al.,* 2004).

The information from literatures of regarding the success of the method of heating in the processing of sugar apple pulp products have not been found. Pulp which is allowed on the open atmosphere can cause color damage due to the polyphenoloxidation enzyme activity. Discolourationoccurs during frozen storage and continue until thawing, which causes the loss of the quality and value of product sales (Goniet *et al.*, 2009). Harshe and Bhagwat (2006) have conducted a research of sugar apple pulp without additives showed discoloration within 2 hours after exposure at room temperature.

Through various efforts of a research were under taken to overcome these obstacles, including a variety of fruit pulp processing, one of which is the frozen products (Maldonado *et al.*, 2004), jam (Pénicaud *et al.*, 2010), fruit mix (Pereira *et al.*, 2010), dry pulp (Pino, 2010), cereal flakes (Pintoet *et al.*, 2005) spray-dried powder (Huchin *et al.*, 2014), nectar (Pino *et al.*, 2003) and beverages (Prieto *et al.*, 2007) with the shelf life six months.

Based on these problems it is necessary to examine the exact ratio between the pulp of sugar apple and carboxymethyl cellulose as a filler in the manufacture of beverage powdered

MATERIALS AND METHODS

Materials and Statistical Analysis. The raw material which used in this research was the pulp of sugar apple that processed into beverage powdered. The supporting material in this study were the CMC, gelatin, sugar and chemicals for analysis. This study used a completely randomized design (CRD), which consists of three variations of the CMC concentration is 0.3; 0.5 and 0.7%.

Stages of Research.

Making Beverage Powdered Without Filtering Pulp of Sugar Apple. Peel of sugar apples and the seeds removed from the ripened fruits then mashed the pulp that has obtained with a blender (200 mL). The fruit juice was added with distilled water, 75 g sugar, CMC (0.3; 0.5; 0.7)% of the total juice. Do heating while stirring for 1 hour to obtain a concentrate. Concentrate obtained was dried in an oven at 40°C for 3-4 hours. Samples that have been obtained then mashed them with a blender for further packaged and analyzed.

Making Beverage Powdered with Filtering Pulp of Sugar Apple. The ripened sugar apple fruits cleaned from the peels and seeds. Subsequently the pulp mashed with a blender (200 mL), and then filtered. the delicate fruit juice added with distilled water, 75 g sugar, CMC (0.3; 0.5; 0.7)% of the total juice. The slurry heated soon while stirred for 1 hour to obtain a concentrate. The concentrate obtained was dried in an oven at 40°C for 3-4 hours. The samples then mashed with a blender for further packaged and analyzed.

Physicochemical Characteristics of Beverage Powdered. The physicochemical characteristics of sugar apple powder was examined for total soluble solid (Goni *et al.*, 2010) solubility (Adebowale *et al.*, 2009), water content (AOAC, 1990), vitamin C content (Cardoso *et al.*, 2011), water holding capacity (Larrauri *et al.*, 1996), oil holding capacity (Larrauri *et al.*, 1996) and fiber content (Pereira *et al.*, 2010) in different concentrations of CMC.

Experimental Design. Statistical data analysis using the software Statistical Product and Service Solutions (SPSS) version 18 with One Way Anova method and Univariate Analysis of Variance with a significant level of 5% in the comparison of means using Duncan method (Trihendradi, 2005).

RESULTS AND DISCUSSION

Total Soluble Solid. Effect of CMC concentration on total soluble solid of the powdered sugar apple can be seen in Figure 1. The results showed that the concentration of CMC did not affect the total soluble solid

in the powdered either by filtering or without filtering the pulp where the result tends to be a stable values with the increasing concentration of CMC particularly in the filtered samples, while the total soluble solid in the samples without filtering pulp tends to decrease with increasing concentrations of CMC.

Total soluble solids was relatively similar to all samples analyzed though some levels of concentration of CMC had been applyed in the powdered beverage of sugar apple. One reason is that the hydrophilic nature of CMC. According by Pereira et al. (2010), CMC dispersed in the water will absorb the water then form cross links within the polymer molecules so that water molecules trapped in it. These conditions resulted in a reduction of total soluble solids, especially in the powdered sample without filtering the pulp where the fiber inside also absorbs water among particles of the poliymer.

The Solubility. Effect of CMC concentration on the solubility of the powdered sugar apple can be seen in Figure 2. The results showed that the concentration of CMC had no effect on the parameter of beverage product both with filtering or no filtering the pulp. Solubility powdered by filtering the pulp tends to decrease with increasing concentration of CMC, but the contrary yield on the sample without filtering pulp.

Similar to the results obtained in total soluble solids, the solubility of sugar apple NutriSari also relatively similar at different concentrations of CMC. This is due to the immobilization of water as a solvent originally come from outside the granules to move freely and then trapped in the polymer structure of the CMC. In addition to this, the presence of hydrophilic and hydrophobic fractions on the structure of the CMC for its ability to stabilize emulsions and colloidal systems.

The results of the study by Mirhosseini et al. (2008) had shown that a concentration of 0.5% CMC was able to stabilize the emulsion on the orange drinks up to six months of commercial storage.

The Water Content. Effect of CMC concentration on water content of sugar apple drinks powdered can be seen in Figure 3.

The results showed that the concentration of CMC did not affect the water content of sugar apple powdered which was made by filtering the pulp, but it affected to the powdered without filtering pulp. Water content in the filtered product tends to decrease with increasing concentration of CMC, while in the beverage without filtering the pulp had a linier relationship between the water content and the increasing of CMC concentration up to 0.7%.

Although CMC has both hydrophilic and hydrophobic fractions on molecular structure, however, the presence of dietary fiber in the pulp of sugar apple without filtering as the reason of CMC to increase the ability of binding water because of the fiber nature is also capable to bind water among the particles of raw material as well as the CMC. The results of the study Huchin et al. (2014) showed that the total dietary fiber content in the pulp of sugar apple was 40.42% db. Furthermore, they also argued that one of the benefits of fiber is slows the absorption of glucose into the blood through the fiber gelling reaction products with water.

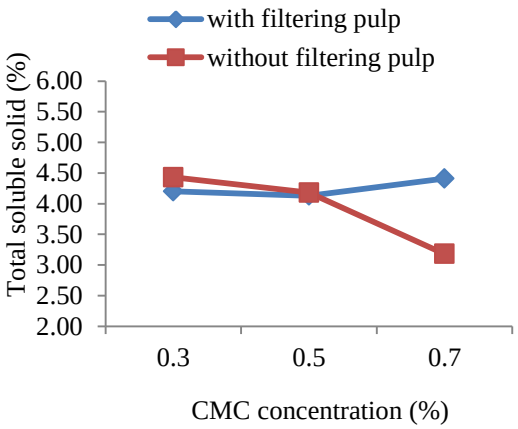

Figure 1.
Effect of CMC on the Total Soluble Solids in Beverage Powdered of Sugar Apple. Different Letters on the Powdered Products Showed The Significant Difference on either with or Without Filtering Pulp (p<0,05).

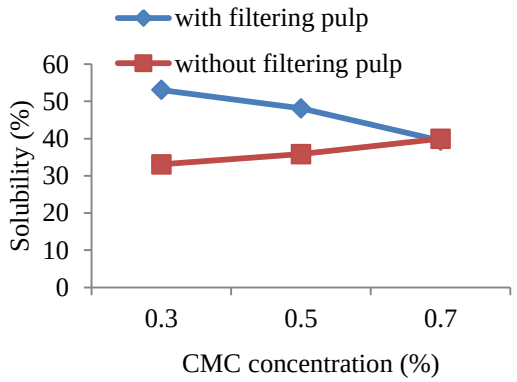

Figure 2.
Effect of CMC on the Solubility in Beverage Powdered of Sugar Apple. Different Letters on The Powdered Products Showed The Significant Difference on Either with or Without Filtering Pulp (p<0,05).

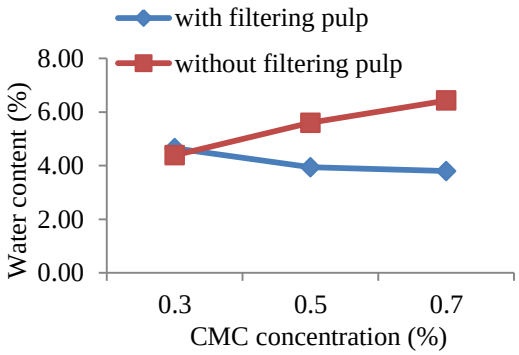

Figure 3.
Effect of CMC on The Water Content in Beverage Powdered of Sugar Apple. Different Letters on The Powdered Products Showed The Significant Difference on Either with or Without Filtering Pulp (p<0,05).

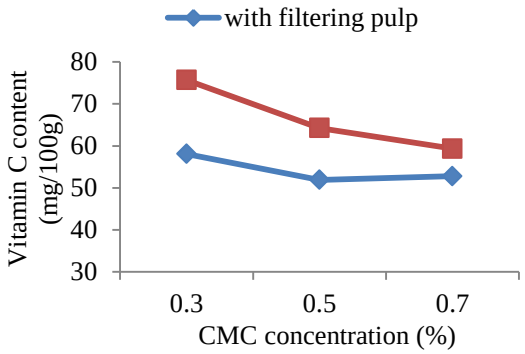

Figure 4.
Effect of CMC on The Vitamin C in Beverage Powdered of Sugar Apple. Different Letters on The Powdered Products Showed The Significant Difference on Either with or Without Filtering Pulp (p<0,05).

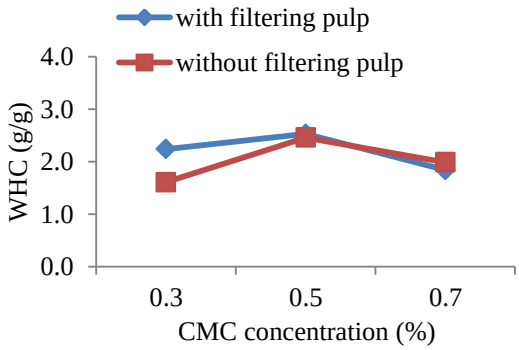

Figure 5.
Effect of CMC on The Water Holding Capacity in Beverage Powdered of Sugar Apple. Different Letters on The Powdered Products Showed The Significant Difference on Either with or Without Filtering Pulp (p<0,05).

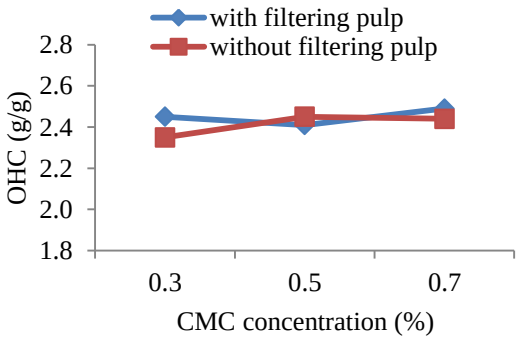

Figure 6.
Effect of CMC on The Oil Holding Capacity in Beverage Powdered of Sugar Apple. Different Letters on The Powdered Products Showed The Significant Difference on Either with or Without Filtering Pulp (p<0,05).

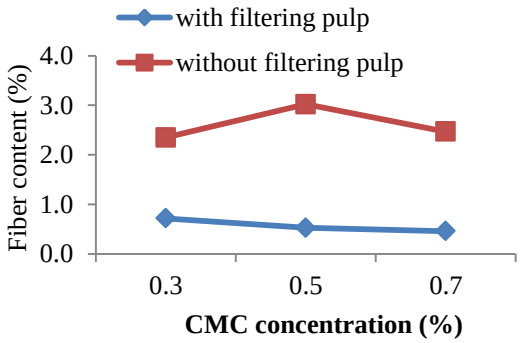

Figure 7.
Effect of CMC on The Fiber Content in Beverage Powdered of Sugar Apple. Different Letters on The Powdered Products Showed The Significant Difference on Either with or Without Filtering Pulp (p<0,05).

Vitamin C. Effect of CMC concentration on the content of vitamin C in the powdered of sugar apple can be seen in Figure 4. The results showed that CMC did not affect the content of vitamin C in the product made by filtering the pulp, but they affected on the beverage without filtering the pulp.

The content of vitamin C in beverage powdered of sugar apple with or without filtering the pulp had a similar pattern i.e. tends to decrease by increasing concentrations of CMC. The samples which obtained by filtering pulp had lower vitamin C content than the product without the treatment.

Vitamin C is soluble in water, therefore an increase in the concentration of CMC that has the ability to bind water also resulted in decreased levels of vitamin C. In addition, the increase in the concentration of CMC will increase the volume of raw materials where levels of vitamin C contained in the pulp was not increased. According Paraskevopoulou et al. (2013) that one of the roles of water-soluble polysaccharides such as CMC is entrapping (trapping) and form a gel (gelling agent).

Functional Characteristics on Beverage Powdered of Sugar Apple. The product had been examined for the water holding capacity (WHO), oil holding capacity (OHC) and the fiber content on different CMC concentrations.

Water Holding Capacity. In this experiment, the WHC of the samples had been analyzed by inserting the powdered of sugar apple into the distilled water and then left to stand for one hour, and after centrifugation the residue weighed. Effect of CMC concentration on the WHC can be seen in Figure 5.

WHC on the powdered which made by filtering the pulp of sugar apple tends to be stable with the increasing concentration of CMC, in contrary on the WHC samples made from the raw material without filtering the material increased up to 0.5% concentration of CMC and then decreased at a concentration of 0.7% CMC. These data indicated that the WHC on powdered product of sugar apple without pulp refining outweigh the powdered samples by filtering the pulp during processing. This was due to the nature of CMC is capable to bind water and reinforced by fibers that are still contained in the pulp without filtering it. This research showed that water holding capacity in sample of sugar apple powdered is in conformity to the total soluble solids and solubility as well as the water content.

Oil Holding Capacity. Oil holding capacity in the product had been analyzed by inserting the sample into oil then left to stand for one hour, thereupon the residue weighed after centrifugation. Effect of CMC concentration on the OHC can be seen in Figure 6.

OHC on beverage powdered of sugar apple which made by with or without filtering the pulp tends to be stable with increasing concentrations of CMC. These data indicated that the product has an OHC was not significantly different in the variation of CMC concentration that used during processing. Although CMC has a hydrophobic fraction as well as another hydrophilic one in its molecular structure, vice versa, the raw material is a polar that caused no capable to adsorb non polar fraction, so that the oil holding capacity was relatively stable.

Fiber Content. Effect of CMC concentration on the fiber content of sugar apple powdered can be seen in Figure 7. The results showed that CMC did not affect the crude fiber content made by filtering the pulp, but the application of CMC influenced to the product without filtering the flesh part of sugar apple.

The fiber content on the powdered beverage of sugar apple which made by filtering the pulp tends to be stable with the increasing of CMC concentration, while the fiber on the product without filtering the raw material increased up to 0.5% CMC then the content decreased on 0.7% CMC.

Decreasing of fiber content on the largest concentration of CMC is due to the

formation of a strong bond and the structure of a compact between the CMC and the sugar apple pulp fibers, so that the resulting particle size of sugar apple powdered is relatively large. These particles are thought to have a limited surface area to contact with the solvent then diffused among the particles during the process of fiber analysis. The results of the study Skuland et al. (2014) shows that there is a linear relationship between the response of the cells with increasing the surface area of the particles.

CONCLUSION

The best characteristic of physicochemical and functional beverage powdered of sugar apple obtained by filtering pulp and 0.5% CMC.

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